

GEOLOGIC MAPPING OF THE NILI FOSSAE REGION OF MARS: MTM QUADRANGLES 20287, 20282, 25287, 25282, 30287, and 30282. Leslie F. Bleamaster III^{1,2}, and David A. Crown¹, Planetary Science Institute, ¹corporate address - 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719; ²mailing – Trinity University Geosciences, One Trinity Place #45, San Antonio, TX 78212, lbleamas@psi.edu.

Introduction: Geologic mapping studies at the 1:1M-scale are being used to assess geologic materials and processes that shape the highlands along the Arabia Terra dichotomy boundary. In particular, this mapping will provide a regional context and evaluate the distribution, stratigraphic position, and potential lateral continuity of compositionally distinct outcrops identified by spectral instruments currently in orbit (i.e., CRISM and OMEGA). Placing these landscapes, their material units, structural features, and unique compositional outcrops into spatial and temporal context with the remainder of the Arabia Terra dichotomy boundary may provide constraints on: 1) origin of the dichotomy boundary, 2) paleo-environments and climate conditions, and 3) various fluvial-nival modification processes related to past and present volatile distribution and their putative reservoirs (aquifers, lakes and oceans, surface and ground ice) and the influences of nearby volcanic and tectonic features on hydrologic processes, including hydrothermal alteration, across the region.

Data and Methods: Datasets include both Viking and THEMIS day IR basemaps, and 128 pixel/deg (~462 m/pixel) MOLA topographic data covering the entire mapping region. These basemaps and other data supplied by the U.S. Geological Survey are in a GIS-ready format. ESRI ArcGIS software in conjunction with a WACOM Cintiq 21 inch interactive display facilitates all mapping linework and geodatabase generation and storage. Because of the vast amount of Mars datasets available (and their highly variable resolutions), mapping proceeds directly on the THEMIS basemap; high-resolution data, when scale appropriate, is visualized using JMARS (Java Mission-planning and Analysis for Remote Sensing) and individual hot-linked images (e.g., HRSC, CTX, MOC). OMEGA and CRISM mineralogy maps generated by collaborator J. Mustard and colleagues will be used to assess and correlate geologic map units with widespread and isolated mineral outcrops including olivine,

pyroxene, hydrated silicate, phyllosilicates, and carbonate detections [1, 2].

Nili Fossae, located north of Syrtis Major volcano and west of Isidis basin, contains a series of curvilinear troughs oriented roughly concentric to the Isidis basin. The largest trough originates from Hesperian age volcanic flows, extends northward through Noachian etched and cratered units, and ends near the dichotomy boundary (Figure 1) [3, 4]. These structures most likely manifest as the surface expression of an outer ring fault related to the reasonably sized topographic and structural basin created by the Isidis impact into the underlying Noachian crust. Nili Fossae crosscuts materials that span the Noachian to late Hesperian and intersects with structural elements potentially related to original dichotomy formation, suggesting that Isidis has long been an influence on local geologic evolution.

Although masked in regions by volcanic flows from Syrtis Major, aeolian and fluvial deposition, and potential coastal deposits related to an ancient Martian ocean [5, 6], subsequent striping has revealed outcrops of significant geochemical importance. Like those observed in the Mawrth Vallis region (see Chuang and Bleamaster, this issue), several outcrops of phyllosilicate-bearing Noachian materials have been revealed by the MEX OMEGA instrument [7, 8]. Phyllosilicates in this location point to the ancient history of Mars when the stability of ground and/or surface water was present for significant periods of time, facilitating the widespread aqueous alteration observed [9].

Units: Geologic contacts, linear features (i.e., faults, ridges, and crater rims) and surface features (i.e., secondary crater chains) mapped thus far are provided in Figure 1. An initial set of geologic units will be built from the existing geologic contacts to be presented and displayed at the meeting. Most geologic units herein subdivide units originally defined by Greeley and Guest (Figure 1) [3] and more recently during northern plains mapping by Tanaka et al. [9] that skirts the area.

Sub-units are typically identified by the occurrence of an individual layer that caps isolated mesas and widespread plateau regions (MOLA topography is helpful in extrapolating some of these units, Figure 1). These cap materials are underlain by weaker materials, which are often preserved only as clusters of knobby terrain that remains after the resistant cap has been removed.

Additional geologic units including lineated valley fill (predominantly in the northwest corner), lineated and concentric crater fill (typical of northern craters), landslide and alluvial fan deposits (i.e., Jezero crater), dunes, and dust deposits are mapped when the scale is appropriate.

References: [1] Murchie et al., 2009: JGR v.114, doi:10.1029/2009JE003342. [2] Ehlmann et al., 2009: JGR v. 114, doi:10.1029/2009JE003339. [3] Greeley and Guest, 1987: US Geol. Surv. Misc. Invest. Ser. Map I-1802B. [4] Craddock, 1994: LPSC XXV, pp. 291-292. [5] Parker, 1989: Icarus, v. 82, p. 111-145. [6] Webb, V.E., 2004: JGR doi:10.1029/2003JE002205. [7] Poulet et al., 2005: Nature, v. 438, doi:10.1038/nature04274. [8] Mustard et al., 2005: Science, v. 307, p. 1594-1597. [9] Mustard and Ehlmann, 2009: NE Syrtis landing site abstract marsoweb.nas.nasa.gov/landingsites/index.html [10] Tanaka et al., 2009: US Geol. Surv. Sci. In. Map 2888.

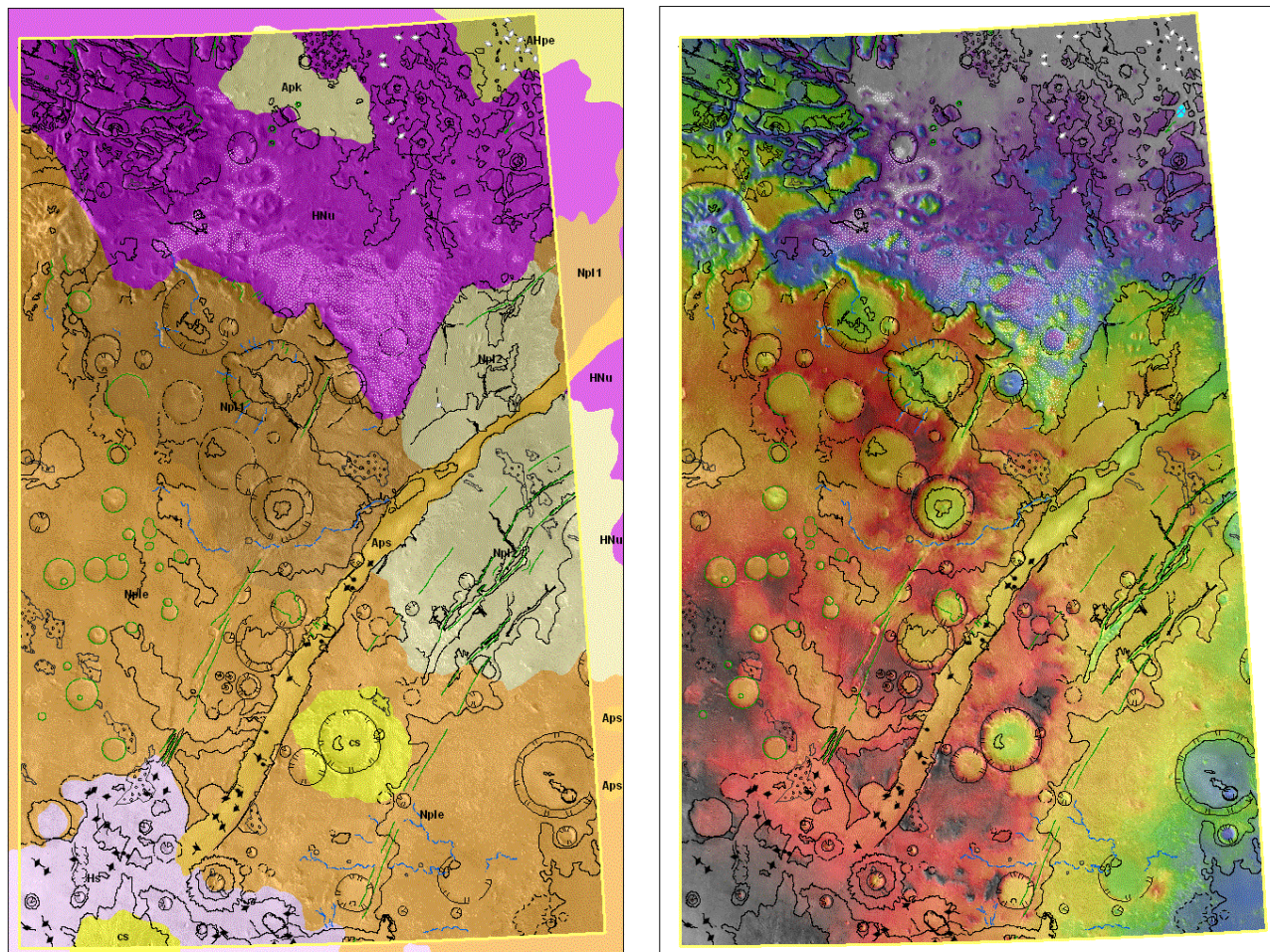


Figure 1. (Left) Present mapping (contacts, linear and surface features) overlain on geologic units (no contacts) of Mars Global Map 1802 [3] (including units, from south to north: **cs** – impact crater material, superposed; **Hs** – Syrtis Major Formation; **Nple** – plateau sequence, etched unit; **Npl2** – plateau sequence, subdued cratered unit; **Npl1** – plateau sequence, cratered unit; **HNu** – undivided material; **Apk** – knobby plains material; and **AHpe** – etched plains material. (Right) Same line work overlain onto MOLA and THEMIS daytime IR basemap.